BOOK REVIEWS

Arc Physics

Max. F. Hoyaux.,
pp 305+xiii Springer-Verlag, Berlin-Heidelborg, New York (1968).

Recently quite a few good textbooks on plasma physics have been published. Here is one exclusively on 'Arc Physics' written by a physicist with very strong engineering back ground. Author says "This is an introduction on the elementary level' Actually the physics of the electric arc is an extremely complicated mixture of different kind of phenomena, skillful use of E. M. theory, Statistical mechanics, Magnetohydrodynamics etc. are required to explain the observed facts. This is a well written book by an expert and surely will be found useful to many in the field as well as to students. Introductory remarks in different chapters are excellent. In addition to general remarks they contain criticism and warns the reader about the scope and limitations of the theories discussed in the particular chapter.

The book is divided into three parts. The first part contains a very well written discussion on the theory of positive column and general theory of Arc Plasma. (According to the present reviewer this is the best part of the book). The second part deals with wall and electrode phenomena. The third part describes plasma diagnostics. It is felt that some of the methods (like temperature determination) given are too brief, this may be due to author's intention to keep the size of the book reasonable. Unlike other texts of this type no extensive bibliography is presented here as the author does not 'sport' in this hobby.

B. C.

The Physical Basis of Ultrahigh Vacuum

P. A. Redhead, J. P. Hobson and E. V. Kornelsen ;
Chapman and Hall Ltd., London, 1968, Price £5-5s net in U.K.

It is well known that ultrahigh vacuum (uhv) *i e.* the region of pressure below 10^{-9} torr is needed for various important scientific and technological purposes, as for example, in systems for plasma physics research, accelerator vaccuum systems, cryogenic systems, space simulators, production of thin films and other solid state devices, and in experiments requiring atomically clear surfaces or high gas purity, also certain other systems of smaller volumes required for scientific research. In order to understand the phenomena in uhv systems and in uhv technology, knowledge of different disciplines, namely, surface physics and chemistry, thermodynamics, electron and ion-impact physics, cryogenics, electronics etc. are required. Therefore, to deal with the physical basis of uhv in a single volume is a formidable task indeed. The authors, who are members of a wellknown group of workers in the field attempted to achieve this in the present volume They have dealt with the physical processes involved in uhv phenomena, pressure measurement in those systems, production of uhv and examples of uhv. But nowhere the authors have attempted to deal with the practical or technological aspect of the subject. They have, however, taken great pains in clearly explaining the physical principles involved in the production, measurement and maintenance of uhv in various systems. The volume will therefore be a useful handbook for all workers, scientists or technologists, in the field of uhv, for whom a knowledge of the basic principles involved in the phenomena are essentially needed.

A. K. D.

Transfer and Storage of Energy by Molecules: Vol. 1 Electronic Energy

G. M. Burnett and A. M. North, Wiley-Interscience, 1969—227 pages.

The book is an attempt to collect and systematize the results of the work done in various branches of science on Energy Transfer in Molecules which are published in different specialised journals. In view of the growing importance of the energy transfer in chemistry, biology and solid state, a book which tries to bridge the gap between spectroscopists and chemical kineticists is definitely welcome. The book consists of four review articles on electronic energy transfer, and it will be followed by Vol 2 and Vol. 3 of the series discussing vibrational and rotational energy transfer, respectively. The first article of the book by Cundall discusses the conversion of electronic energy to vibrational and translational forms as deduced from experiments in the gas phase on atoms and diatomic & polyatomic molecules. The third article by Kearwell & Wilkinson emphasizes the work done in the condensed phase with organic polyatomic molecules, and discusses fluorescence, phosphorescence, tripet-triplet absorption and photochemical yield in relation to the properties of electronically excited states. This article overlaps to some extent with the first article, and the two perhaps could have been combined into one to present the materials in a more systematic fashion. The second article of the book by J. N. Bradley essentially discusses the reverse problem of conversion of other forms of energy to electronic energy as deduced from shock wave studies, while the fourth and the last article discusses the problems connected with the transfer of large amounts of energy from highly energised particles and radiation. All the articles are well-written and can be easily followed by physical organic chemists. However, I feel that an article on theories of radiationless process and energy transfer, and another on experimental techniques would have helped to bring completeness to the discussion. The articles emphasize the basic idea involved but make no attempt to be exhaustive, or to collect all the work done up-to-date.

The book will be a good addition to a chemical library.

M. C.

The World of Mars

V. A. Firsoff, 1969, pp 128, price 7sh 6d, Oliver & Boyd, Edinburgh.

This little book covers practically the entire information available on the planet Mars up-to-date. The author is himself a wellknown worker in Areology and speaks with authority and conviction on the subject. The writing is informative, instructive and intriguing. The confrontation between telescopic and other earthbound instrumental observations and the close range but limited observations by Mariner 4 probe, has been critically discussed to show the pitfalls in arriving at conclusions on Martian geography, geology, meteorology and ecology derived from either class of data. The mysteries of Schiaparelli's "Canals", the seasonal color and topological variations, some of the most intriguing and controversial subjects on Mars, have been given as logical an explanation as is to be expected, considering all the conflicting data. A layman to fully appreciate the book would be expected to have a fairly good knowledge of several associated subjects, but for the specialist it should be a source of pleasure to go through and ruminate over the many problems of Mars, only the fringe of which appears to have been touched as yet. There seems to be now little logical doubt that Mars contains plant and bacterial life and the necessary factors for their sustenance. Whether the "canals" of Mars

are really subterranean aqueducts, whether some of the observed mushrooming clouds on Mars are from nuclear explosions or whether the mysterious twin satellites of Mars are really huge spacecrafts, indicating existence and activities of Martians, such conclusions according to the author are improbable but not impossible. But without more unambiguous data it is still premature to build up a theory of the Martian World, and the day is perhaps not very far off when manned spacecrafts going round or landing on Mars or Lunokhod type robots roaming round Martian landscape will settle all controversy. Until then most of the theories on Mars are to remain "not proven for the time being" as the author very cautiously asserts.

A. B,

Atomic Spectra

H. G. Kuhn, F.R.S., Second Edition 1969,
Longmans Green & Co. Ltd.,
London & Harlow, pp. 472+xviii, price 105sh.

This book on Atomic Spectra by Dr. Kuhn is a departure from the previous standard books on this subject. His method of exposition of the subject is also different. In the second chapter he has given the outlines of the theoretical methods required for the understanding of the mechanics of the atom which, as he himself has pointed out, is not meant to be a complete exposition of the complex mathematical techniques of quantum mechanics.

In succeeding chapters he has systematically expounded the methods applied for the elucidation of the atomic spectra starting from the simple spectra of hydrogen and hydrogen-like atoms through those of helium, alkali metals, alkaline earth metals, trivalent elements and ending in the complex spectra of higher members of the periodic table. All the concepts have been neatly developed giving the necessary mathematical treatments wherever necessary and illustrating the subjects with diagrams, tables and photographs of the spectra.

Dr. Kuhn has elaborately discussed the very important aspects of linear and quadratic Stark effects and those of Zeeman effects in simple, doublet and complex spectra.

In two special chapters he has dealt exclusively the subjects of hyperfine structure, isotope shift, width and shape of spectral lines on which he himself has made many contributions. The importance of the radiofrequency methods for studying the hyperfine structures has been specially discussed though the details of the experimental methods have been left out for obvious reasons.

The addition of many recently developed aspects of the atomic spectra such as Lamb shift in hydrogen, deuterium, singly ionised helium and doubly ionised lithium, atomic beam resonance, optical bumping, auto-ionisation etc., have made the book more up-to-date, though according to the author himself, it has not been possible to include all the new materials of current researches within the framework of the book.

This book though meant for more advanced undergraduate and graduate students, undoubtedly will be of much help to research workers in the field of atomic spectra. Moreover, the large number of references included in the bibliography has increased the usefulness of the book. This book is a valuable addition to the existing works on Atomic Spectra.

G. S. K,

Spectra and Energy Levels of Rare Earth Ions in Crystals

Gerhard H. Dieke,

Interscience Publishers, 1968, 401 pages.

G. H. Dieke is one of the pioneers who have done extensive investigations of the properties of the rare earth ions in crystals. Before World War II, the main interest was confined to Uranyl compounds for obvious reasons. After the war availability of pure rare earth compounds in good quantity resulted in a spurt of investigations on these ions. When lasers were invented in the early sixties, the potential use of rare earth ions as active material for lasers was recognised and now a good many people are working in this field. Dieke and his co-workers have made decisive contributions.

The book under review is mainly concerned with the optical properties of rare earth ions in crystals. It is mainly based on the author and his co-workers work and includes many unpublished results. Experimental procedures are lucidly presented and a large amount of experimental data is incorporated. The necessary theoretical methods are developed in a concise way in appropriate places. References are very extensive and useful. One can say without reservations that this is an important and welcome addition to the existing literature in this field.

A. S. C.

Books Recently Received for Review

An Introduction to Liquid Helium, J. Wilks, £ 2.40, Clarendon Press, Oxford, England.

Glass Lasers, K. Patek, £ 6.50, London Iliffe Books, (Butterworth & Co.), London.

Atomic and Nuclear Physics. An introduction in S. I. Units, Ed. T. A. Littlefield and N. Thorley, £ 0.75, English Language and Book Society and Van Nostrand Reinhold Co., London.

Thin film Physics, O. S. Heavens, £ 2.00, Methuen and Co. Ltd., London.

Electron Diffraction, T. B. Rymer, 50S, Methuen & Co. Ltd., London.

Nuclear and Particle Physics Annual (*Vol.* 1), Ed. Leon Lederman and Joseph Wenzer, $30.60, Gordon and Breach Science Publishers Ltd., London.

Topics in Theoretical Physics, Ed. Christofer Cronstrom, $ 36.00, Gordon and Breach Science Publishers, London.

Astrophysics and General Relativity, *Vol.* 1, Ed. M. Chretien, S. Deser and J. Goldstein, $ 21.00, Gordon and Breach Science Publishers, London.

Photophysics of Aromatic molecules, John B. Birks, John Wiley & Sons, New York.

Mathematical and theoretical Physics, *Vols.* 1 *and* 2, Egil A. Hylleraas, Vol. $15.00, Vol. 2-15.00, John Wiley and Sons, New York.

Symmetry Principles and Atomic Spectroscopy, Brian G. Wybourne, $ 17.50, John Wiley & Sons, New York.

Applied Matrix and Tensor Analysis, John A. Eisele and Rober M. Mason, John Wiley & Sons, New York.

Properties of Matter, B. H. Flowers and E. Mendoza, $ 15.50, John Wiley & Sons, New York.

Fundamentals of Aeronomy, R. C. Whitten and I. G. Poppoff, $ 14.95, John Wiley & Sons., New York.